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# THE USE OF HERBICIDES FOR SITE PREPARATION AND THEIR EFFECTS ON TREE SURVIVAL

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## Summary

Herbicides can be used for site preparation on steep erodable land where minimum soil disturbance is desirable. Picloram is one of the most effective herbicides. Its effects on planted mahogany are long lasting, and its successful use depends upon the density of the forest canopy and understory at the time of application.

## Resumen

Los yerbicidas pueden usarse para la preparación del sitio en terrenos inclinados y susceptibles a la erosión donde no es deseable remover el suelo. Picloram es uno de los yerbicidas más efectivos. Sus efectos en árboles de caoba plantados son duraderos y su uso satisfactorio depende de la densidad del dosel y del sotobosque al tiempo de aplicación.

Site preparation by hand labor is the highest cost for establishing plantations on steep and erodable lands in many areas of the humid tropics. This is especially true for areas covered with high brush or secondary forest. Therefore, herbicides were tested in an effort to reduce site preparation costs.

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* In cooperation with the University of Puerto Rico.

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Several herbicides recently tested on tropical trees in Puerto Rico gave excellent results[1/]. Some of them appeared promising for site preparation under local conditions. However, problems such as herbicide persistence in the soil and susceptibility of planted species were unknown. We began a study in one of the areas treated by the Agricultural Research Service in the Luquillo Experimental Forest to solve these problems.

## Objective

The main purpose of the study was to determine the interval required between applying herbicidal treatments and successfully establishing planted mahogany[2/], pine and cadam. We also wanted to define herbicide effectiveness in maintaining weed free conditions.

## Forest Description

The experimental area, representing the commercial timber land of the Luquillo Experimental Forest, is a typical example of an often-cutover humid tropical forest. The stand is heterogeneous, consisting mainly of Roble, Hoja menuda, Guaba, Moca, Yagrumo macho, Yagrumo hembra, Laurel geo, Sierra palm, tree ferns and others in the upper canopy. Heights ranged from 35 to 45 feet, with a dense understory of the most tolerant species. Elevation is about 1,000 feet. The soil is a plastic clay with big boulders. Annual rainfall is about 100 inches, two-thirds of which falls between May and October.

## Methods

Five treatments were tested, each replicated once. The herbicides were applied from the air undiluted as foliage sprays (Table 1).

Planting began four weeks after the herbicides were applied. Then one row of five seedlings each of mahogany, pine and cadam (15 seedlings per row) was planted every week for ten consecutive weeks in each plot for a total of 150 trees, 50 trees per species per plot. The mahogany and cadam seedlings were planted barerooted. The pines were bagged, but the bags were removed at planting time. Trees were randomly row planted at a 1.52 x 1.52 meter (5' x 5') spacing.

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1/ U. S. Department of Agriculture, Agricultural Research Service, Crops Research Division, Federal Experiment Station, Mayaguez, P. R., Annual Report 1965-66.

2/ Scientific names of trees mentioned are listed at the end of the paper.

Table 1.—Herbicide treatments applied

| Treatment | Herbicide | Pounds/acre |
|---|---|---|
| 1 | Picloram[1/] | 12 |
| 2 | Picloram | 6 |
| 3 | Picloram | 3 |
| 4 | 1.5 lbs Picloram + 6 lbs 2,4,5-T[2/] | 7.5 |
| 5 | 6 lbs 2,4-D[3/] + 6 lbs 2,4,5-T | 12 |

1/ 4-amino - 3,5,6 trichloropicolinic acid
2/ 2,4,5 - trichlorophenoxyacetic acid
3/ 2,4 - dichlorophenoxyacetic acid

## Results

Picloram applied at 6 and 12 pounds per acre caused distortion of the lower leaves of mahogany. However, not all the mahogany seedlings in every row were affected. Seedlings with living overhead protection were not affected by concentrations of Picloram as high as 12 pounds per acre. All the affected seedlings had recovered normal growth 5-1/2 months after the last row was planted.

We observed no herbicidal damage to seedlings in any of the rows in plots treated with Picloram at a rate of 3 pounds per acre. This treatment, however, was ineffective in overstory control. Therefore, we assumed that a negligible amount of the herbicide reached the understory. In a comparison study still underway, similar concentrations of the same herbicide applied directly to the understory affected mahogany seedlings planted four weeks after treatment.

Treatment 4, Picloram 1.5 pounds + 2,4,5-T 6 pounds/acre, and treatment 5, 2,4-D 6 pounds + 2,4,5-T 6 pounds/acre, were less effective in overstory control than treatments 1 and 2, but more effective than treatment 3. Treatment 3 was the least effective of all the treatments (Table 2).

There was no evidence of herbicide damage to pine or cadam in any of the treatments. Survival of the cadam, however, was very low in all plots due to their succulent condition at planting time.

## Conclusions

Herbicides can be used for site preparation on steep erodable land where minimum soil disturbance is desirable. Picloram is one of the most effective herbicides. Its effects on planted mahogany are long lasting, depending upon the density of the forest canopy and understory at the time of application.

For sparse overstory conditions, Picloram at 6 pounds per acre will eliminate understory vegetation and maintain weed free conditions for several months. Planting of mahogany, however, should be delayed for at least three months to avoid foliar damage.

For dense overstory conditions, Picloram at 12 pounds per acre is sufficient to open the canopy and reduce understory competition.

Table 2.--Overstory defoliation and survival of planted Mahogany, Pine and Cadam

| Treatment Number | Herbicide in Pounds/acre | % Defoliation[1/] after treatment | | % Survival[2/] at the end of | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2.5 months | | | 5.5 months | | |
| | | 3 months | 6 months | M | P | C | M | P | C |
| 1 | Picloram 12# | 83 | 76 | 85 | 96 | 11 | 82 | 91 | 12[3/] |
| 2 | Picloram 6# | 80 | 60 | 92 | 93 | 31 | 91 | 88 | 19 |
| 3 | Picloram 3# | 29 | 27 | 94 | 90 | 43 | 93 | 90 | 36 |
| 4 | Picloram 1.5# + 2,4,5-T 6# | 52 | 40 | 90 | 85 | 29 | 86 | 70 | 27 |
| 5 | 2,4-D 6# + 2,4,5-T 6# | 65 | 52 | 90 | 95 | 42 | 83 | 84 | 38 |

1/ Information supplied by the Agricultural Research Service.

2/ Survival counts were made 2-1/2 and 5-1/2 months respectively after the last row was planted.

3/ Some trees sprouted back after the first measurement.

## SPECIES MENTIONED IN TEXT

| | |
|---|---|
| Cadam | *Anthocephalus cadamba* (Roxb.) Miq. |
| Guaba | *Inga vera* Willd |
| Hoja menuda | *Myrcia splendens* (Sw.) DC. |
| Honduras Mahogany | *Swietenia macrophylla* King |
| Laurel geo | *Ocotea leucoxylon* (Sw.) Mez |
| Moca | *Andira inermis* (W. Wright) H. B. K. |
| Sierra palm | *Euterpe globosa* Gaertn. |
| Pine | *Pinus caribaea* var *hondurensis* Morelet |
| Roble | *Tabebuia heterophylla* (DC.) Britton |
| Tabonuco | *Dacryodes excelsa* Vahl |
| Tree fern | *Cyathea arborea* (L.) J. E. Smith |
| Yagrumo hembra | *Cecropia peltata* L. |
| Yagrumo macho | *Didymopanax morototoni* (Aubl.) Decne. & Planch. |